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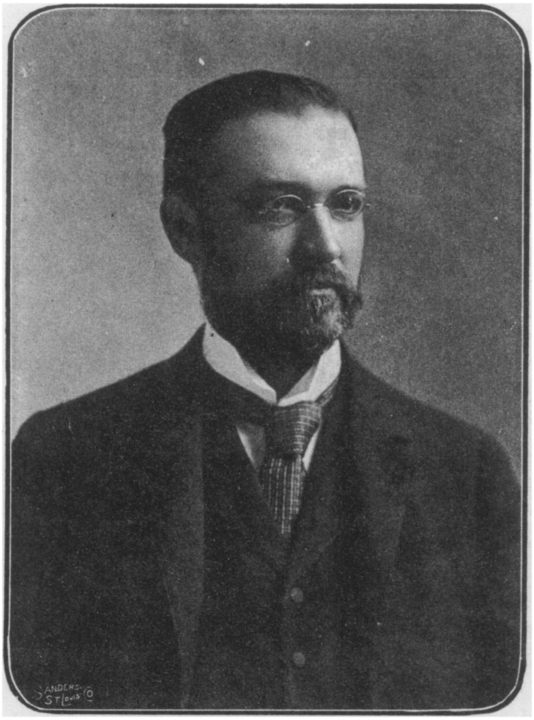

THOMAS CRAIG.

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BIOGRAPHY.

PROFESSOR THOMAS CRAIG, C. E., PH. D.

By **F. P. MATZ, Sc. D., Ph. D.**, Professor of Mathematics and Astronoy in Defiance College, Defiance, Ohio.

The subject of this sketch was born at Pittston, Pennsylvania, December 20, 1855. He was the son of Alexander Craig, a Scotch mining engineer. In the common schools of his native town he distinguished himself for his assiduity and success in study. From the very beginning of his scholastic career, he was a remarkably bright student. With several of his townsmen, he entered Lafayette College in September, 1871. Four years later he was graduated with the degree of Civil Engineer, and delivered the "Scientific" *Honorary* Oration. The same year he received honorable mention in mathematics at the Inter-Collegiate Contest in New York City. While a student in Lafayette College, he was a member of the Franklin Literary Society, and of the *Upsilon Beta* and of the *Delta Kappa Epsilon* Fraternities.

Says Registrar Coffin of Lafayette College: "In Pittston he received enthusiasm from Prof. William J. Bruce, a teacher who made him his protege. His conduct was always exemplary, and his moral character unspotted. For digging up a lamp post belonging to the city of Easton and transplanting it to the grounds of Lafayette College, he and some other students were detected by the police, fined by the Mayor, and coercively removed (rusticated) by the Faculty to Frazer, Pennsylvania, to study alone for one month under the charge of that accomplished teacher, Rev. John C. Clyde, D. D., pastor of the Presbyterian Church. This method of treatment cured the entire party of a desire to engage in further mischief.''

After receiving the degree of Civil Engineer from Lafayette College, he engaged in studying mathematics and teaching at Newton, New Jersey. As a student of advanced mathematics under the direction of Professor Sylvester, he entered the Johns Hopkins University in 1876. He was one of the first persons elected to a fellowship in mathematics at the Johns Hopkins University. This fellowship he held from 1876 to 1879, and received the degree of Doctor of Philosophy in 1878. He began lecturing in this University when he was a student. After receiving the degree of Doctor of Philosophy, he became connected with the United States Coast and Geodetic Survey, for which he prepared in 1879 a Treatise on the Mathematical Theory of Projections. For many years he was associated with *The American Journal of Mathematics* as a contributor and as assistant editor; and from 1894 to 1899, he was the responsible editor of this mathematical journal.

He rose, by successive promotions, from the grade of Fellow to those of Associate, Associate Professor, and Professor of Mathematics. During his stay in Washington he studied the Theory of Functions from the work of Königsberger, under the guidance of Professor Simon Newcomb. Among his special studies may be mentioned the theory of functions, differential equations, mechanics, and hydrodynamics. He kept pace with the most rapid advances in mathematical learning. Many of his contributions can be found in the *American Journal of Mathematics* from 1876 to 1900, and many other of his contributions have been published in various foreign mathematical journals. He was a member of a number of mathematical and scientific societies.

With subjects which received extensive development in the hands of such illustrious mathematicians as Sylvester, Cayley, Hermite, Poincaré, Darboux, Appel, Picard, Abel, and others, he was.actively engaged for the benefit of the readers of the *American Journal of Mathematics.* In the capacity of editor of this mathematical journal, Dr. Craig was eminently successful in securing the contributions of distinguished mathematicians of England and the Continent, whose letters show high appreciation of the abilities of their American editor and correspondent.

That Dr. Craig was very *optimistic* is well known to the writer, whose senior he was by some years. Writes President Gilman in his Annual Report of the University of 1900: ''Kindness toward young men and readiness to encourage them were among his admirable qualities.'' Speaking from a personal acquaintance extending over many years, the writer always found Dr. Craig to be an efficient workman, a pleasant companion, a warm friend, and a good man. With his students he associated familiarly, and occasionally he invited them to spend a mathematical evening at his home. Dr. Craig was an admirable lecturer. He had the ability to communicate what is known. His lectures were always thoroughly prepared; and he always had a comprehensive, accurate, and clear knowledge of what he intended to impart. It is well known that, as a lecturer, Dr. Craig thought quickly, spoke rapidly, and wrote with great celerity. It is true that some of his lectures on differential equations, on hydrodynamics, and on the theory of functions were very advanced and very difficult; and those lectures could be followed with profit only by the maturest of his students.

There is published by the D. Van Nostrand Company his *On the Motion of a Solid in a Fluid.* His most elaborate work *Linear Differential Equations* is published by John Wiley & Sons.

In a private letter, Professor Coffin of Lafayette College says: "His was a wonderfully strong mind."

Likewise, Prof. Simon Newcomb says: "As a student Dr. Craig had a remarkable power of rapid comprehension of mathematical treatises."

Likewise, President Gilman says: "Dr. Craig was a man of unusual aptitudes and of great promise, who began a brilliant career with us; but he suffered long from ill health—and of late years, he was the victim of insomnia."

"Likewise, his father—Mr. Alexander Craig, says: "My son, Thomas Craig, was married to Miss Louise Alvord, of Washington, D. C., May 4, 1880. She is the daughter of the late General Benjamin Alvord of the United States Army"

A Baltimore paper says: "Dr. Thomas Craig, the Professor of Pure Mathematics in the Johns Hopkins University, died suddenly of heart failure, May 8, 1900, at his residence, 1822 St. Paul Street. He had been complaining of feeling unwell for several weeks, although he was at the University as usual that morning. He returned home about noon, and went to his room for a rest before dinner. A member of the family went to call him for dinner and found him dead. Coroner Saunders gave a verdict of death from heart failure."

Dr. Craig is survived by his father and a sister, Miss Margaret Craig, both of Pittston, Pennsylvania; and, also, by his widow and two daughters, Miss Alisa Craig and Miss Ethel Craig, who reside in Baltimore. Says his father: "He was buried at Pittson, Pennsylvania, by the side of his mother whom he always loved so well."

In his Annual Report of the University for 1900 President Gilman writes: "The death of Professor Craig occurred on the 8th of May, 1900, after a long period of declining powers. Those who knew Dr. Craig only in his declining years, need to be told of the enthusiasm, the diligence, and the learning which for a long period were his distinguishing characteristics. He was one of a company of bright young mathematicians who came to the University in its first year, attracted by the brilliant reputation of Professor Sylvester. He showed at once extraordinary powers of acquisition, as well as great ability in the treatment of certain subjects in the domain of higher mathematics. In addition to his contributions to mathematical journals, he published, in 1879, two manuals on the elements of the mathematical theory of fluid motion, and, in 1889, the first volume of a treatise on linear differential equations, a continuation of which was not completed at the time of his death."

In the *American Journal of Mathematics* for October, 1900, Prof. Simon

Newcomb writes as follows: "Thomas Craig, the former editor of this journal, and Professor of Pure Mathematics in the Johns Hopkins University, died May 8, 1900, in his forty-fifth year. His connection with the *American Journal of Mathematics*, as editor or associate editor, continued through the greater part of its existence, being severed at the end of 1898, when failing health compelled him to retire from the editorship. Craig was connected with the Johns Hopkins University from its foundation. He was attracted thither by the desire to pursue mathematical studies under the guidance of Sylvester. From the beginning he showed an extraordinary development of the faculty of acquisition, being able to master, almost without effort, the writings of any of the great geometers to which he was attracted. The productive faculty was developed more slowly.

He was naturally among the earliest Doctors of the University, and the first, or one of the first, to graduate in mathematics. His earliest publications were two small books on hydrodynamics, and a work on projections, prepared for the U. S. Coast Survey, with which he was associated for a short period after his graduation. His most elaborate separate work was a treatise on Linear Differential Equations, embodying the course of instruction on that subject which he gave to the students of the University. A work on higher geometry, on which he was engaged, but, so far as the writer is aware, on which he had made little progress. were left unfinished at the time of his death.

He was also a frequent contributor to the pages of this journal. Among the contributions worthy of especial mention were his various papers on Theta functions, in the fifth and sixth volumes, and a memoir on Linear Differential Equations whose fundamental integrals are the successive derivatives of the same function, in the eighth volume.

During his editorship he devoted himself with great energy to the interests of the *Journal*. The principal object of at least one of his visits abroad was to interest European geometers in it. He recognized and admired the genius of Poincaré; and two elaborate memoirs by the latter, which appeared in the seventh and eighth volumes, were believed to have been sent to the *Journal* on Craig's personal solicitation.

As an expounder of mathematical subjects to advanced students, Craig's abilities were of a high order. His lectures were well prepared, and he spoke with rapidity, clearness and force. It may well be that only the best students were able to keep up with him, but these profited in a high degree from his expositions and entertained a permanent appreciation of his efforts for their development. Concentrating his interests almost entirely on his family and his students, rarely taking a long rest, he mingled little with men, especially in his later years, when his activities were greatly restricted by failing health."

At a meeting of the (Johns Hopkins) Board of University Studies, held May 23, 1900, the following minute was unanimously adopted:

"The members of the Board of University Studies of the Johns Hopkins University desire to express their sorrow at the death of their friend and colleague, Prof. Thomas Craig, who, as student and teacher of mathematics, had been connected with the University for nearly the entire period of its existence. One of the brilliant young men whom Professor Sylvester attracted to the University in its early days, he won straightway the favorable notice of that eminent man for the enthusiasm and intellectual acumen with which he entered upon the study of advanced mathematics, then almost an unknown science in this country; and this fortunate combination of interest, energy, and ability characterized his entire career. At the time of his death he was occupied in the preparation of a treatise on the Theory of Surfaces. Undoubtedly the intense ardor with which he engaged in this work contributed in large measure to that impairment of the nervous system from which he had recently suffered. Professor Craig possessed great power of research, and wrote much for various mathematical journals. For many years he was editor of the *American Journal of Mathematics*, and it is largely due to his zeal and able direction that that journal continues to hold its high rank in the mathematical world. Professor Craig occupied a place in the very front rank of American mathematicians. His scientific ideals were the highest, and as teacher, editor, and investigator, he brought to his work a high degree of originality, and an intellectual ardor which was a source of inspiration to all with whom he was closely associated."

ON SYSTEMS OF ISOTHERMAL CURVES.*

By PROFESSOR L. E. DICKSON.

1. The object of this paper is to give an elementary geometrical definition of a system of isothermal curves in the plane. The definition is readily extended to families of curves on any algebraic surface. For simplicity of expression, the definition is given in connection with the two families of curves which are to be discussed at length; the general definition will then be apparent. The usual methods of treating the subject are indicated in §§ 4-5.

2. The concentric circles about a point O have as orthogonal trajectories the straight lines through O. Select two of these lines, OP and OQ, and designate by q the number of radians in the angle POQ. On the circle about O with radius $OP=r$, the arc $PQ=qr$. On the line OP measure off from P the length $PT=qr$. [In Fig. 1, it is taken to the right of P]. On the circle about O with radius $OT=r+qr$, the arc TS equals $qr+q^2r$. Hence PQ, PT and QS are each of length qr, while the limit of $TS \div PT$ as q approaches zero is unity.

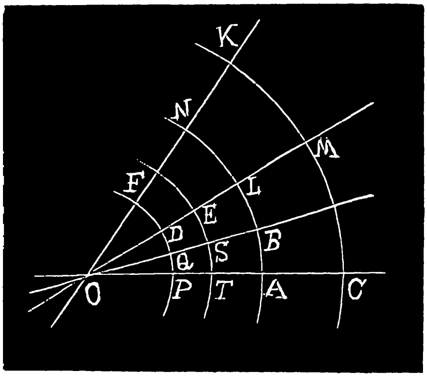

Fig. 1.

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*Read before the American Association for the Advancement of Science.